Amendment and Response
Applicant: John Rausch et al.
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Title: ORIFICE PLATE AND METHOD OF FORMING ORIFICE PLATE FOR FLUID EJECTION DEVICE

IN THE CLAIMS

Please cancel claims 1-23 without prejudice.

Please add new claims 46-58.

Please amend claims 24, 33, 34, and 45 as follows:

1-23. (Cancelled)

24. (Currently Amended) An orifice plate for a fluid ejection device, the orifice plate comprising:

a first layer formed of a metallic material and having a first side and a second side opposite the first side, the first layer having an orifice defined in the first side thereof and a first opening defined in the second side thereof, the first opening communicating with the orifice; and

a second layer formed of a polymer material and having a second opening defined therethrough, the second layer disposed on the second side of the first layer and the second opening communicating with the first opening,

wherein a diameter of the orifice and a diameter of the second opening are both greater than a minimum diameter of the first opening, and

wherein a thickness of the second layer is substantially equal to a thickness of the first layer.

25. (Original) The orifice plate of claim 24, wherein the second layer is formed after the first layer.

26. (Original) The orifice plate of claim 24, wherein the first layer is electroformed and the second layer is deposited on the first layer.

27. (Original) The orifice plate of claim 24, wherein the metallic material of the first layer includes one of nickel, copper, an iron/nickel alloy, palladium, gold, and rhodium.

28. (Original) The orifice plate of claim 24, wherein the polymer material of the second layer includes a photoimageable polymer.

29. (Original) The orifice plate of claim 24, further comprising:

a protective layer disposed on the first side of the first layer.

30. (Original) The orifice plate of claim 29, wherein the protective layer is provided within the orifice and the first opening of the first layer.

31. (Original) The orifice plate of claim 29, wherein the metallic material of the first layer includes one of nickel, copper, and an iron/nickel alloy, and the protective layer includes one of palladium, gold, and rhodium.

32. (Original) The orifice plate of claim 24, wherein the first layer and the second layer each have a thickness in a range of approximately 5 microns to approximately 25 microns.

33. (Currently Amended) ~~The orifice plate of claim 24~~An orifice plate for a fluid ejection device, the orifice plate comprising:

a first layer formed of a metallic material and having a first side and a second side opposite the first side, the first layer having an orifice defined in the first side thereof and a first opening defined in the second side thereof, the first opening communicating with the orifice; and

a second layer formed of a polymer material and having a second opening defined therethrough, the second layer disposed on the second side of the first layer and the second opening communicating with the first opening,

wherein a diameter of the orifice and a diameter of the second opening are both greater than a minimum diameter of the first opening, and

wherein the first layer and the second layer each have a thickness of approximately 13 microns.

34. (Currently Amended) A fluid ejection device, comprising:

a substrate having a fluid opening formed therethrough;

a drop generator formed on the substrate; and

an orifice plate extended over at least a portion of the drop generator, wherein the orifice plate includes a first layer formed of a metallic material and a second layer formed of a polymer material,

wherein the first layer has an orifice and a first opening communicated with the orifice formed therein, and the second layer has a second opening communicated with the first opening formed therein, and

wherein a diameter of the orifice and a diameter of the second opening are both greater than a minimum diameter of the first opening,

wherein a thickness of the second layer is substantially equal to a thickness of the first layer.

35. (Original) The device of claim 34, wherein the second opening of the second layer forms a fluid chamber for the drop generator, wherein the fluid chamber communicates with the fluid opening of the substrate.

36. (Original) The device of claim 34, wherein the drop generator includes a firing resistor formed within a thin-film structure, wherein the thin-film structure is adjacent to the substrate and the orifice plate is supported by the thin-film structure.

37. (Original) The device of claim 36, wherein the orifice plate is adhered to a bonding layer, wherein the bonding layer is adjacent to the thin-film structure.

38. (Original) The device of claim 34, wherein the first layer of the orifice plate is electroformed and the second layer of the orifice plate is deposited on the first layer after the first layer is formed.

39. (Original) The device of claim 34, wherein the metallic material of the first layer of the orifice plate includes one of nickel, copper, an iron/nickel alloy, palladium, gold, and rhodium.

40. (Original) The device of claim 34, wherein the polymer material of the second layer of the orifice plate includes a photoimageable polymer.

41. (Original) The device of claim 34, wherein the orifice plate further includes a protective layer disposed on a side of the first layer.

42. (Original) The device of claim 41, wherein the protective layer is provided within the orifice and the first opening of the first layer of the orifice plate.

43. (Original) The device of claim 41, wherein the metallic material of the first layer of the orifice plate includes one of nickel, copper, and an iron/nickel alloy, and the protective layer of the orifice plate includes one of palladium, gold, and rhodium.

44. (Original) The device of claim 34, wherein the first layer and the second layer of the orifice plate each have a thickness in a range of approximately 5 microns to approximately 25 microns.

45. (Currently Amended) ~~The device of claim 34~~A fluid ejection device, comprising:

a substrate having a fluid opening formed therethrough;

a drop generator formed on the substrate; and

an orifice plate extended over at least a portion of the drop generator, wherein the orifice plate includes a first layer formed of a metallic material and a second layer formed of a polymer material,

wherein the first layer has an orifice and a first opening communicated with the orifice formed therein, and the second layer has a second opening communicated with the first opening formed therein,

wherein a diameter of the orifice and a diameter of the second opening are both greater than a minimum diameter of the first opening, and

wherein the first layer and the second layer of the orifice plate each have a thickness of approximately 13 microns.

46. (New) A fluid ejection device, comprising:

a substrate having a fluid opening formed therethrough;

a thin-film structure formed on the substrate and including a drop generator;

an orifice plate extended over at least a portion of the drop generator; and

a bonding layer interposed between the orifice plate and the thin-film structure,

wherein the orifice plate includes a first layer formed of a metallic material and a second layer formed of a polymer material, wherein the first layer has an orifice and a first opening communicated with the orifice formed therein, and the second layer has a second opening communicated with the first opening formed therein, and wherein a diameter of the orifice and a diameter of the second opening are both greater than a minimum diameter of the first opening.

47. (New) The device of claim 46, wherein the second opening of the second layer forms a fluid chamber for the drop generator, wherein the fluid chamber communicates with the fluid opening of the substrate.

48. (New) The device of claim 46, wherein the orifice plate is oriented substantially parallel with the bonding layer.

49. (New) The device of claim 46, wherein the orifice plate is oriented substantially parallel with the drop generator.

50. (New) The device of claim 46, wherein the first layer of the orifice plate is electroformed and the second layer of the orifice plate is deposited on the first layer after the first layer is formed.

51. (New) The device of claim 46, wherein the metallic material of the first layer of the orifice plate includes one of nickel, copper, an iron/nickel alloy, palladium, gold, and rhodium.

52. (New) The device of claim 46, wherein the polymer material of the second layer of the orifice plate includes a photoimageable polymer.

53. (New) The device of claim 46, wherein the orifice plate further includes a protective layer disposed on a side of the first layer.

54. (New) The device of claim 53, wherein the protective layer is provided within the orifice and the first opening of the first layer of the orifice plate.

55. (New) The device of claim 53, wherein the metallic material of the first layer of the orifice plate includes one of nickel, copper, and an iron/nickel alloy, and the protective layer of the orifice plate includes one of palladium, gold, and rhodium.

56. (New) The device of claim 46, wherein a thickness of the second layer of the orifice plate is substantially equal to a thickness of the first layer of the orifice plate.

57. (New) The device of claim 46, wherein the first layer and the second layer of the orifice plate each have a thickness in a range of approximately 5 microns to approximately 25 microns.

58. (New) The device of claim 46, wherein the first layer and the second layer of the orifice plate each have a thickness of approximately 13 microns.